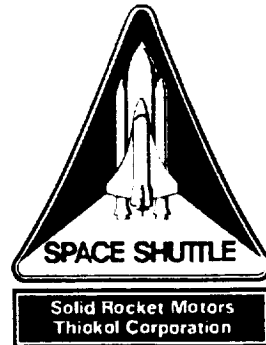


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## FINAL REPORT- NEW RUBBER QUALIFICATION FOR THE IGNITER ADAPTER

13-jan-1994

Prepared for:

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## 1.0 INTRODUCTION

Kirkhill Rubber Company (KRC) has informed Thiokol Corporation that two raw materials used in the asbestos and silica filled NBR formulation per STW-2621 are no longer available from their vendors.

Agerite White (Di-beta-naphthyl-paraphenylene diamine), manufactured by B. F. Goodrich, is an antioxidant used in NBR. This raw material makes up roughly 1%-2% of the finished product. KRC has proposed that this raw material be replaced by Agerite Stalite S (mixture of octylated diphenylamines) distributed by R. T. Vanderbilt Co.

Protox-166 zinc oxide, manufactured by Zinc Corporation of America, is an activator currently used in NBR. This material also makes up about 1% to 2% of the finished material. Protox-166 is an American process grade zinc oxide. It is proposed by KRC to replace Protox-166 with Kadox-930C a French process grade zinc oxide. American process grades have an ASTM minimum purity of 99.0%; the French process grades have a minimum purity of 99.5%.

Previous testing per WTP-0270 has demonstrated that the mechanical and thermal properties of the rubber with the new ingredients are comparable to the "old" rubber. The test results are reported in TWR-61790.

One igniter adapter, Part no. 7U77562-02 serial no. 2 was insulated per ETP-1206 using the new rubber formulation and a modified lay up and cure method to demonstrate that there is no impact on this process. This TWR will report the results of this demonstration.

## 2.0 TEST OBJECTIVE

The objective was to demonstrate that the new rubber formulation along with a modified lay up and cure technique will produce acceptable parts.

### 3.0 APPLICABLE DOCUMENTS

The latest revision of the following documents apply to the extent specified herein.

<u>Number</u>	<u>Title</u>
STW4-2621	Insulation, Acrylonitrile Butadiene Rubber (NBR), Asbestos and Silicon Dioxide-Filled(Unvulcanized Calendered Stock and Vulcanized Molded Components)
TWR-61752	Test Report Evaluation of Replacing Protox-166 with Kadox-903 and Replacing Agerite White with Agerite Stalite S in NBR
WTP-0270	Test Plan, NBR antioxidant and activator evaluation
TWR-61790	Test Report, NBR antioxidant and activator evaluation
PTP-0072	Evaluation of igniter adapter insulation process with new NBR formulation
TWR-65404	Final report for PTP-0072, Evaluation of igniter adapter insulation process with new NBR formulation
TWR-65403	Evaluation of Igniter Chamber Insulation Process with new NBR Formulation
7U77562-02	LAT Adapter assy., igniter-insulated

#### 4.0 SUMMARY AND CONCLUSION

One igniter adapter, Part no. 7U77562-02 serial no. 2 was insulated using typical production planning, equipment and personnel in X-20. The insulated adapter was dimensionally inspected per typical planning and procedures. No dimensional differences from previously insulated adapters were detected by the dimensional inspection.

A new lay up technique, referred to as the "spiral wrap" was used to make this part. The new method facilitates and requires accurate control of the weight of rubber that is charged into the mold. It had previously been documented that the mold would often open a small amount during cure due to the expansion of the rubber when too much rubber was loaded into the mold. The new method should result in a more reproducible process since the mold will not be as subject to overloading.

In addition to the modified rubber and the new lay up technique, the cure cycle was modified to achieve a full 1.0 equivalent cure.

It is concluded that the new rubber, when processed with the new lay up and cure methods, had no detrimental effect on the acceptability of the igniter adapter insulation.

#### 5.0 RECOMMENDATION

It is recommended that the new rubber formulation along with the modified lay up and cure process, be incorporated into the igniter adapter insulation process.

#### 6.0 DISCUSSION

The new rubber has previously been qualified by testing (refer to TWR-61790 and TWR-61752) and is in use in flight configuration case hardware. It has also been demonstrated and qualified for the igniter chamber per TWR-65403. The tests using igniter hardware were a formality to ensure that there is not a unique condition in the igniter that would react adversely to the new formulation.

During PTP-0072 testing it was determined that the cure cycle in use did not provide one equivalent cure as determined per GIS-6.1 (please refer to TWR-65404). The cure cycle was consequently extended by 30 minutes (from 2 hours to 2.5 hours at 290 to 310° F). The extended cure cycle was used in this testing.

The "spiral wrap" lay up technique which was used in this testing is fully documented in TWR-65404. This method eliminates the cutting and fitting that was previously done on each ply and allows accurate weight control of the rubber placed into the mold.

Part No. 7U77562-02 serial no. 1 was also made per ETP-1206 using the same methods discussed above except that it had 70 grams less rubber placed in the mold. This part was unacceptable because there was an unfilled area on the J-leg. There are two molds in use for this operation. The PTP-0072 testing used one mold but this serial number 1 adapter was made with the other mold. The second mold apparently requires slightly more rubber to fill the cavity. Future processing will use the increased rubber amount (increased by 70 grams) to ensure that all molds are filled.